REMARKS

Rejections of Claims 1, 2, 4 and 5 under 35 USC § 103

In the Office Action, Examiner quoted an appropriate paragraph of 35 USC § 103 which provides that a patent may not be obtained if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

Therefore, Examiner rejected claims 1-2, 4-5 as being unpatentable over Liu (US Patent 6,323,123) in view of Ding (US Patent 5,981,145).

Response to Rejections of Claims 1

Integrated circuit formation, or more specifically dual damascene patterning, is primarily a chemical reaction-based process. As identified in Applicant's specification, the problem of photoresist poisoning arises when low-K dielectric material is used as an insulating layer over the substrate. In solving this problem, the solution should not be restricted to a structural barrier between the insulating layer and the photoresist. Rather, claim 1 of Applicant's specification recites and teaches how both a structural and a chemical barrier is formable to substantially prevent photoresist poisoning when low-K dielectric material is used as an insulating layer over a substrate in a dual damascene process. In addition, claim 1 discloses that the sacrificial layer must be of a thickness of 800-2000 angstroms for it to effectively function as a structural barrier.

In addition, claim 1 of Applicant's invention teaches the use of different materials for forming the sacrificial layer and for filling the aperture. For example, the anti-reflective coating employed as the sacrificial layer formed over the insulation layer must have good anti-reflection properties, and the fill-in material used for filling the aperture should have good flow properties to facilitate flow thereof into the aperture to thereby cover the walls of the aperture. Therefore, claim 1 of Applicant's invention enables the function of the sacrificial material to be decoupled from that of the fill-in material.

Applicant agrees with Examiner that similar to claim 1 of Applicant's invention, Ding also discloses the step of depositing anti-reflective material onto the insulation layer for forming a sacrificial layer thereon with the sacrificial layer being in contact with the fill-in material. Applicant again agrees with Examiner that Ding describes the use of spin on glass as the fill-in material and that anti-reflective material (for preventing the glisten of surface) is used in place of the sacrificial layer. However, Applicant does not agree with Examiner that the fill-in material and the anti-reflective material are indicated by Ding to have different material properties. In fact, Applicant respectfully submits that Examiner is applying hindsight in relation to the different material properties as the different material properties are not described in Ding.

Firstly, Ding specifically explains that the fill-in material (such as siloxane or methyl siloxane) is applied using a partial-cured spin-on glass (P-SOG) method. Contrary to Examiner's understanding, P-SOG and SOG are methods typically used for the deposition of siloxane solutions. Therefore, spin-on glass does not refer to a specific material although it is usually used in association with organosiloxane solutions.

Secondly, the mention of spin on glass (method) in Ding may have led Examiner to infer that organosilicate glass is used as the fill-in material. Applicant respectfully submits that organosilicate glass is different from the organosiloxane (siloxane or methyl siloxane) described in Ding. Being less dense and having different surface wetting properties when compared to organosilicate glass, organosilixane can effectively be used with the P-SOG method for filling a via-hole.

Thirdly, the fill-in material and the anti-reflective layer (ARL) in Ding are for describing different structures. Primarily, the fill-in material and the ARL in Ding forms one unitary structure but are given different names due to the differences in methods employed for forming each thereof. After the fill-in material has been deposited in a via-hole formed in a dielectric layer in Ding, an etch-back process is used for exposing the dielectric layer before the ARL is formed thereover. This is due to the inability for dimensional control when the P-SOG method is used for filling the via-hole. Therefore, the terms "fill-in material" and "ARL" are strictly used for structural segregation and not for indicating material or material property differences.

Fourthly, a person having ordinary skill in the art will be endowed with the knowledge that siloxane, methyl siloxane or the like organosiloxane are materials commonly used as anti-reflective coatings. Therefore, a person having ordinary skill in the art on reading Ding will identify that Ding teaches the use of anti-reflective material for both the fill-in material and the ARL. Contrary to Examiner's understanding, Ding specifically indicates that both the ARL and the fill-in material have the same material properties.

Therefore, a person having ordinary skill in the art with knowledge of both Liu and Ding will be taught a via-first dual damascene process that uses the same material for filling the via-hole and for forming the sacrificial layer (or ARL) and to avoid the use of material having different materials properties as taught by claim 1 of Applicant's invention for forming decoupled structural and chemical barriers.

In accordance with the submitted amendments and the above response, reconsideration and withdrawal of the rejections to claim 1 is respectfully requested.

Response to Rejections of Claims 2 and 4

Claim 2 recites the step of full filling the aperture in the step of filling the aperture of claim 1. Claim 4 recites the step of filling the aperture with solvent-based fill-in material in the step of full filling the aperture of amended claim 2. Claim 5 recites the use of water-soluble fill-in material for full filling the aperture.

In light of the above response to rejections to claim 1, combining Ding and Liu would have yielded a process step that is different and distinct from the process step of each of claims 2, 4 and 5. Specifically, use of fill-in material for aperture full-filling, solvent free fill-in material and water-soluble fill-in material having material properties that are different from that of the sacrificial layer is not obvious in the absence of each of claims 2, 4 and 5 and without the teaching of claim 1 of Applicant's invention. Therefore, the process step of each of claims 2, 4 and 5 is distinct from the via-first dual damascene process described by Liu and Ding in combination or independently.

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In accordance with the above response, reconsideration and withdrawal of the rejections to each of claims 2, 4 and 5 are respectfully requested.

Conclusion

If any fees or time extensions are inadvertently omitted or if any fees have been overpaid, please appropriately charge or credit those fees to Conley Rose Deposit Account Number 03-2769 and enter any time extension(s) necessary to prevent this case from being abandoned.

Respectfully submitted,

Jonathan M. Harris
PTO Reg. No. 44,144
CONLEY ROSE, P.C.
(713) 238-8000 (Phone)
(713) 238-8008 (Fax)
ATTORNEY FOR APPLICANTS